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G09F 13/18

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(56) Documents Cited:
GB 2314962 A
DE 029617657 U1
DE 004230726 A1
DE 004219293 A1
JP 100149123 A
JP 090258679 A
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US 6208466 B1

(58) Field of Search:
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Other: Online: EPODOC, PAJ, TXTE, WPI.

(54) Abstract Title: Solar powered edge illuminated sign.

(57) A lighting system comprises a light box 10 having a light source 12 associated with one edge 14, at least one display surface 16,18 having scattering elements (not shown) for distributing the light, and a photovoltaic arrangement (not shown), which may include a charge storage device, for powering the light. The light box may comprise a cavity into which light is provided, with the structure of the display surface providing total internal reflection 22 within the cavity. The display surface may have a pattern of scattering elements, and may comprise an array of printed elements, with the density of the scattering elements increasing from a low density near the light source to a high density away from the light source (see fig. 2). The scattering pattern may be asymmetric from one side edge of the cavity to the other, and the display surface may be on a sheet which defines one face of the cavity, with the structured display surface being provided on the other side of the sheet. The lighting system may be in the form of an advertising board, and may be incorporated in a bus shelter with the photovoltaic cell being provided on the roof (see fig. 3).

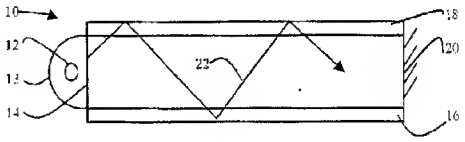

FIG. 1

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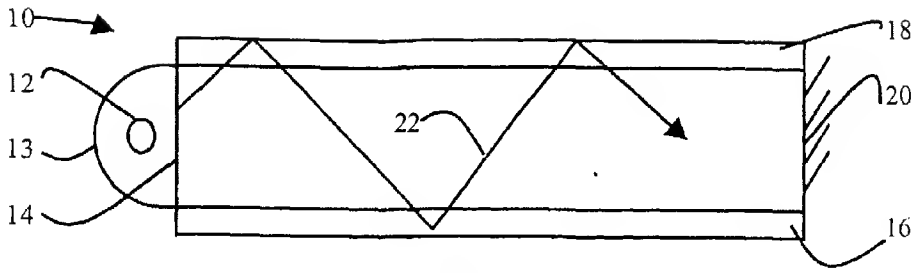

FIG. 1

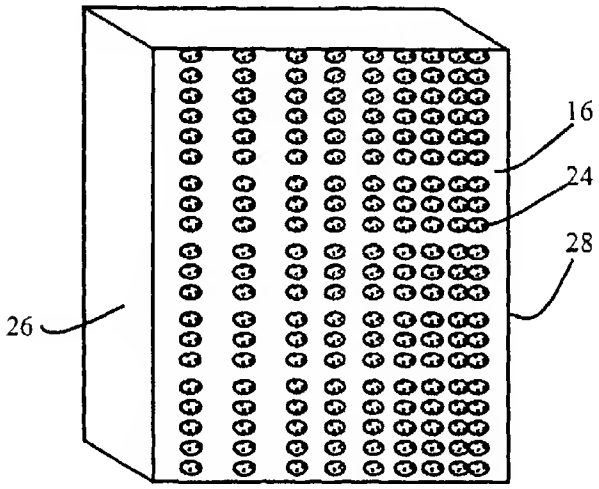

FIG. 2

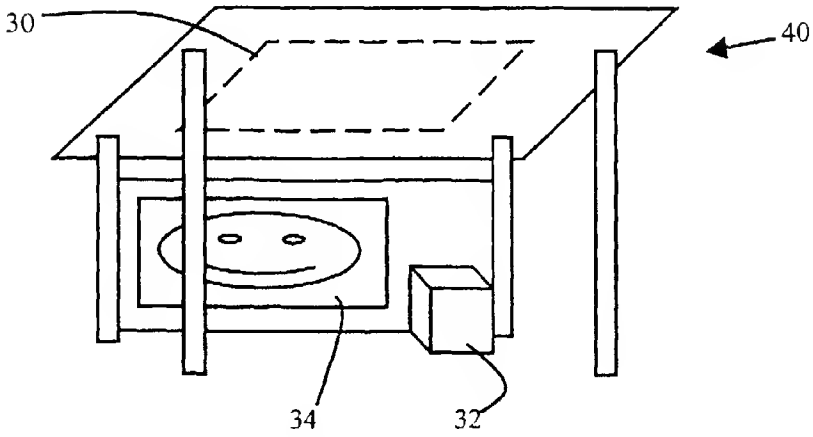

FIG. 3

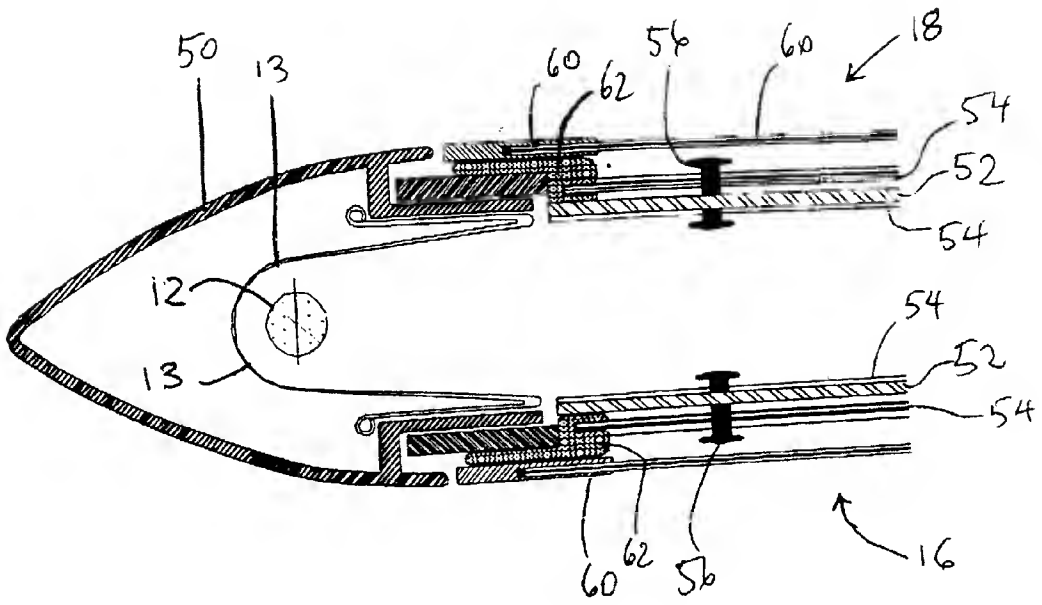

FIG. 4

A LIGHTING SYSTEM

This invention relates to lighting systems, for example light boxes for housing advertisements to be displayed in public places.

Free-standing advertising displays are becoming increasingly popular, as well as advertising displays incorporated into shelters, such as bus shelters. A light box is a common way of providing illumination for an advertisement, and typically comprises multiple light sources which provide light inside the cavity. The structure of the light box is designed to emit light out of one surface or two opposite surfaces forming the cavity, and this area of light output is used to illuminate a poster-type image.

The light box is typically mains-powered, and the advertising display is mounted at a particular location with power supplied to the device from the mains network, for example from an underground junction beneath the location of the advertising display.

According to the invention, there is provided a lighting system, comprising:

a light box;

a single light source associated with one edge of the light box, the light box having at least one display surface from which a light output is provided, the display surface having an arrangement of scattering elements for distributing the light output across the display surface; and

a photovoltaic arrangement for powering the light source.

A single light source within the light box reduces to a minimum the power requirements of the light box, so that the light box can be powered by a solar cell arrangement. The system can then be located independently of the mains power network.

The light box preferably comprises a cavity into which light from the light source is provided, and wherein the structure of the at least one display surface is arranged to provide internal reflection within the cavity. This internal reflection results in the light from the light source being distributed throughout the cavity. The display surface is

then provided with a pattern of scattering elements to enable light to escape from the cavity. The pattern is arranged to provide a reasonably uniform illumination surface. The pattern may comprise an array of printed scattering elements.

The light source is preferably provided at one side edge of the cavity, and the pattern has a greater area density of scattering elements near a side edge of the cavity remote from the light source than near the side edge of the cavity close to the light source. This enables the reasonable uniformity to be provided despite the proximity of the light source to one edge of the cavity. Thus, the pattern from one side edge to the other side edge is asymmetric.

The display surface may be provided on a sheet which defines one face of the cavity, with one side of the sheet provided with the structured display surface, and the other side of the sheet provided with the pattern of scattering elements.

A charge storage device, charged by the photovoltaic arrangement, is preferably provided.

The system may form an advertising board, for example for incorporation into a bus shelter, and the photovoltaic arrangement is then provided on a roof of the bus shelter.

An example of the invention will now be described in detail with reference to the accompanying drawings, in which:

Figure 1 shows a light box used within the lighting system of the invention;
Figure 2 shows a printed pattern on the light box of Figure 1; and
Figure 3 shows a lighting system of the invention; and
Figure 4 shows in greater detail the lamp arrangement in the system of Figure 3.

The invention relates to lighting systems, for example for displaying illuminated advertisements. A light box provides a two dimensional output surface, and a single light source feeds light into the light box from an edge. The light box is solar powered.

Figure 1 is used to explain the operation of the light box used within the lighting system of the invention. The basic construction of light boxes will be well known to those skilled in the art, and the basic operation only will be described with reference to Figure 1.

The light box 10 is viewed from above in Figure 1, and includes a single light source 12 located adjacent to one edge 14. The light source is housed within a reflective casing 13 so that the majority of the light is directed into the light box 10. The light source may be a fluorescent tube mounted vertically to provide edge illumination. The light box has front and rear faces 16,18 and a reflective edge 20 opposite the light source 12. The light from the light source 12 enters a cavity defined by the light box, and the front and rear faces 16,18 are designed normally to provide total internal reflection, so that light within the cavity undergoes multiple reflections (as shown by arrow 22) and is thereby distributed within the cavity.

There are various possible designs for the faces 16,18. For example, these may comprise multi-layer dielectric reflectors, which provide total internal reflection for certain angles of incidence.

One known design of reflector suitable for this purpose comprises a film having a series of prisms on one surface and a smooth opposite surface. The structure of the prisms is arranged such that for a wide range of angles of incidence, light is reflected by the refractive index difference at the smooth surface interface. Thus, there is near total internal reflection by the film. This total internal reflection can be modified by printing a pattern on the smooth surface of the film, which causes the light striking the pattern to be scattered. This introduces a wide range of angles of propagation, so that some of the light can escape through the film at the location of the pattern.

The design of the printed pattern enables a reasonably uniform two dimensional light output to be provided. In particular, the density of the pattern can be varied to change the area over which light can escape.

The printed pattern may comprise a vignette pattern, namely a half-tone print pattern with variable dot density or size altering the local area of print. The prism structure is arranged as prismatic ridges extending parallel to the light source, and the vignette pattern is printed in the same direction as the prisms.

Figure 2 shows in exaggerated form the printed pattern on the smooth side of the face 16. The printed surface may be on the inside surface of the film and the prism surface on the outside surface of the film. An additional protective sheet may overlie the prism surface. As shown, the pattern comprises an arrangement of dots 24, of for example UV ink. The dot size will typically be 4 to 8 dots per square cm. The ink may be matt white.

To allow for expansion of the film, it can be suspended between a pair of clear polycarbonate (or other transparent material) sheets, in a manner to allow some movement to avoid bowing or buckling.

In Figure 2, the light source is not shown, but is for mounting on the left side 26. The pattern of dots 24 has increasing density away from the light source, as shown schematically in Figure 2. The pattern is therefore asymmetric. The maximum density is not, however, at the opposite edge 28, but at a position before that edge, because of the reflection at the edge 28.

Figure 3 shows one use of the complete system of the invention. The system includes a photovoltaic arrangement 30 (a solar cell panel or panels) for powering the light source. A battery 32 stores generated power during day time hours and supplies power to the light source during hours of darkness via a controller. An image 34 is illuminated by the light box in the form of an advertisement. Figure 3 shows the use of the system integrated with a bus shelter 40.

Figure 4 shows in greater detail the lamp arrangement. The reflective casing 13 has an internal surface which defines a parabolic reflector, with the light source 12 arranged at the focal point. This avoids the need for a lens to collimate the light from the light

source to be directed into the cavity. Eliminating the need for a lens improves the efficiency of the lighting system.

The reflective casing 13 is clipped to a removable cover 50, which enables access to be provided to change the light tube 12.

Figure 4 also shows in more detail the construction of the front and rear faces 16, 18. Each face has an optical film 52 sandwiched between acrylic sheets 54, for example 2mm thick. The optical film and two sheets together define the face, and the three components are held together with clips 56. The clips allow differential expansion of the width of the optical film 52 and the acrylic sheets, in particular by providing a loose coupling. The openings in the acylic sheets and the optical film may also be larger than the shaft of the clips 56, so that differential expansion between these components in the plane of the face can also be accommodated.

The light box has an outer frame 60 which may be top hinged and provided with a lock at the bottom, and the image to be illuminated is placed between the outer frame 60 and the side face (i.e. the assembly of the optical film 52 and acrylic sheets 54). A seal 62 is provided around the outer frame 60.

Although the light box is shown as having two opposite light output faces, only one may be required, in which case the opposite face will be a reflector. A bus shelter is of course only one example of a suitable "host" for the system of the invention. An alternative is a free-standing light box, but with the solar panels mounted elsewhere, for example on a nearby bus shelter.

Only one example of the specific construction of the film used to define the walls of the light box cavity has been described, and the materials are readily available. Whilst the use of a prismatic surface has been described, this is not essential and other selectively transmissive arrangements will be known to those skilled in the art. Examples are given in US 6208466.

Whilst the optical film is described as sandwiched between acrylic sheets, other transparent materials can be used, and indeed other arrangements are possible.

CLAIMS

1. A lighting system, comprising:

a light box;

a single light source associated with one edge of the light box, the light box having at least one display surface from which a light output is provided, the display surface having an arrangement of scattering elements for distributing the light output across the display surface; and

a photovoltaic arrangement for powering the light source.

2. A system as claimed in claim 1, wherein the light box comprises a cavity into which light from the light source is provided, and wherein the structure of the at least one display surface is arranged to provide total internal reflection within the cavity.

3. A system as claimed in claim 2, wherein the display surface is provided with a pattern of scattering elements.

4. A system as claimed in claim 3, wherein the pattern comprises an array of printed scattering elements.

5. A system as claimed in claim 4, wherein the light source is provided at one side edge of the cavity, and the pattern has a greater density of scattering elements near a side edge of the cavity remote from the light source than near the side edge of the cavity close to the light source.

6. A system as claimed in claim 3 or 4, wherein the pattern from one side edge to the other side edge is asymmetric.

7. A system as claimed in any one of claims 2 to 6, wherein the display surface is provided on a sheet which defines one face of the cavity.

8. A system as claimed in claim 7, wherein one side of the sheet is provided with the structured display surface, and the other side of the sheet is provided with a pattern of scattering elements.

9. A system as claimed in any preceding claim further comprising a charge storage device, charged by the photovoltaic arrangement.

10. A system as claimed in any preceding claim, comprising an advertising board.

11. A bus shelter incorporating a system as claimed in claim10, wherein the photovoltaic arrangement is provided on a roof of the bus shelter.

Application No:	GB 0224467.1	**Examiner:**	Matthew Jefferson
Claims searched:	1 to 11	**Date of search:**	13 October 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X Y	X. 1, 9 & 10. Y: 1 to 10	JP 09 258679 A	(TOSHIBA) See abstract and figures.
X Y	X: 1, 9 & 10. Y: 1 to 10.	DE 4230726 A1	(POWROSLAWSKI ET AL.) See abstract and figure.
X Y	X: 1, 9 & 10. Y: 1 to 10.	JP 10 149123 A	(MITSUBISHI) See abstract and figures.
Y	1 to 10	US 6208466 B1	(LIU) See, in particular, column 17, lines 15 to 41 and figures 11 and 24.
Y	1 to 6, 9 & 10.	GB 2314962 A	(FAIRFIELD) See whole document.
Y	1 to 10.	DE 4219293 A1	(WILLING) See figures.
Y	1 to 10	DE 29617657 U1	(BURRI AG) See abstract and figures.
Y	1 to 10.	JP 2000 214808 A	(HAYASHI) See abstract and figures.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[V]:

Worldwide search of patent documents classified in the following areas of the IPC[7]:

G02B; G09F.

The following online and other databases have been used in the preparation of this search report:

Online EPODOC, PAJ, TXTE, WPI.